

# Integrated Water Recovery Systems at Johnson Space Center

**Karen D. Pickering, Ph.D.**  
**Michael R. Callahan, Ph.D.**

**Crew and Thermal Systems Division**  
**NASA Johnson Space Center**





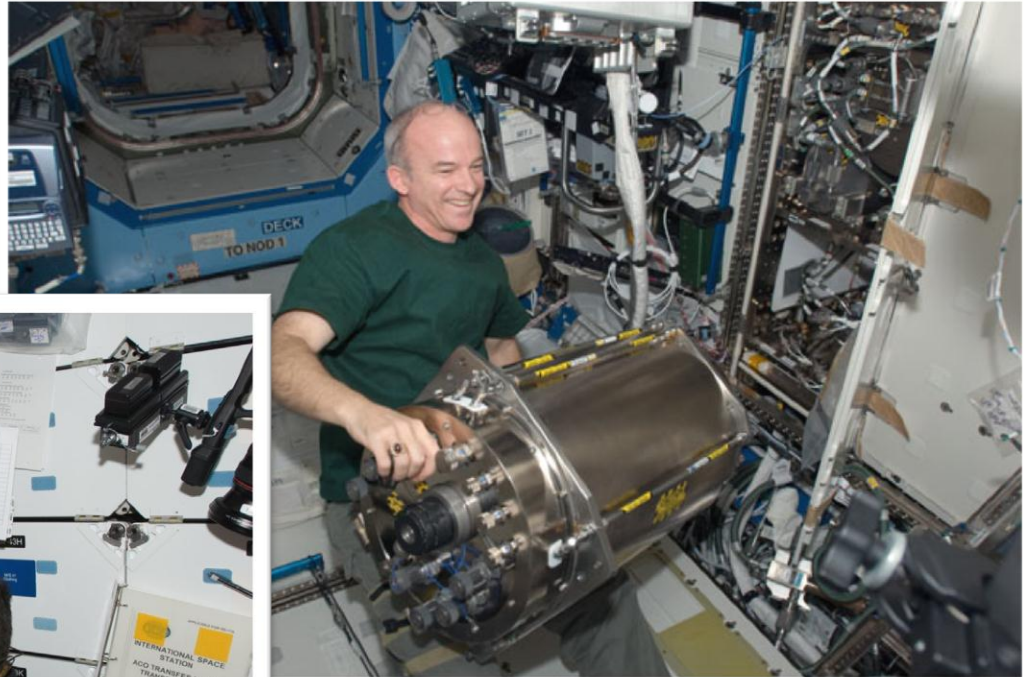
# Why Water?



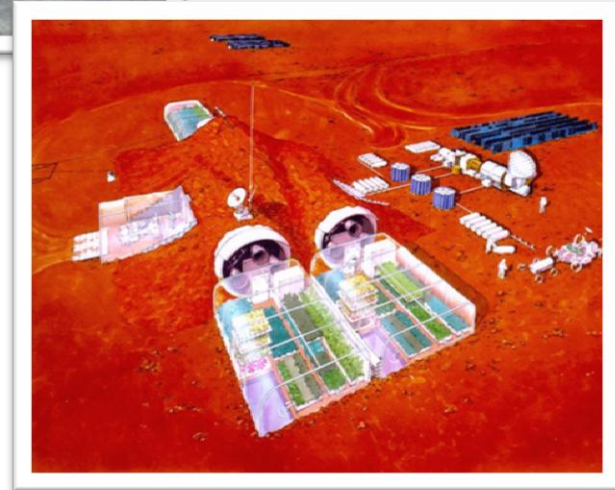
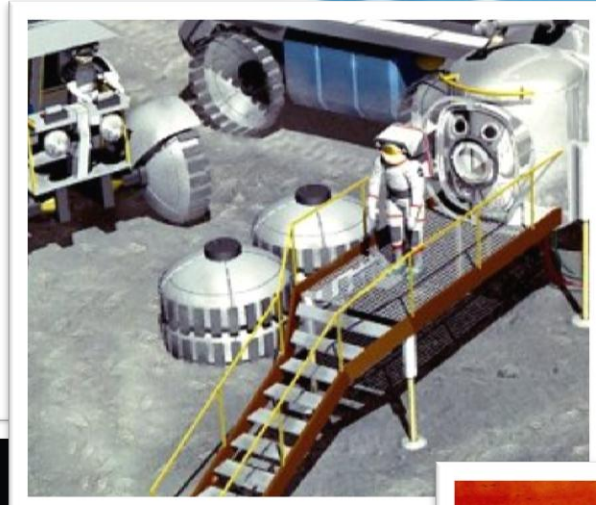




# What we do in space

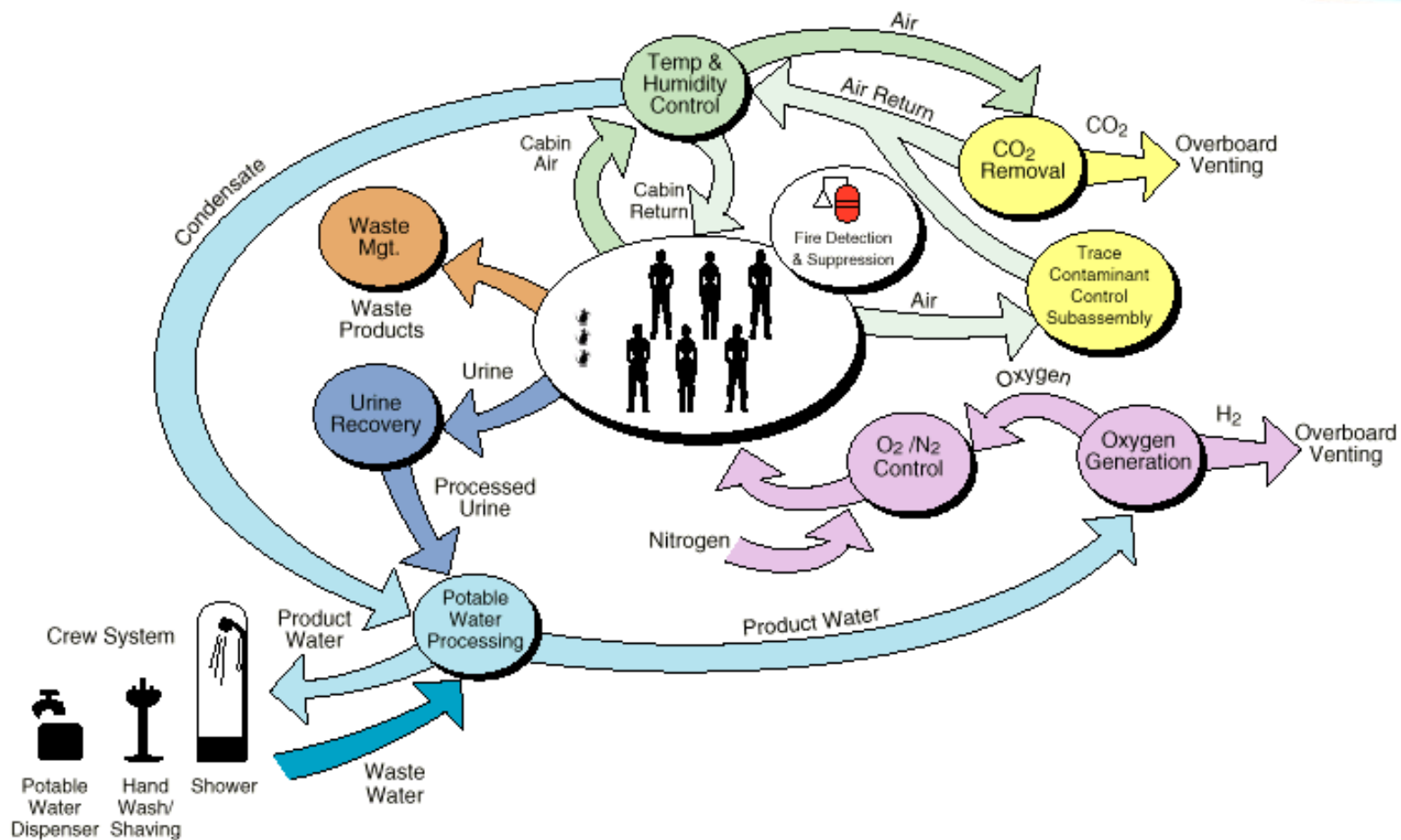


# Water requirements change as mission matures



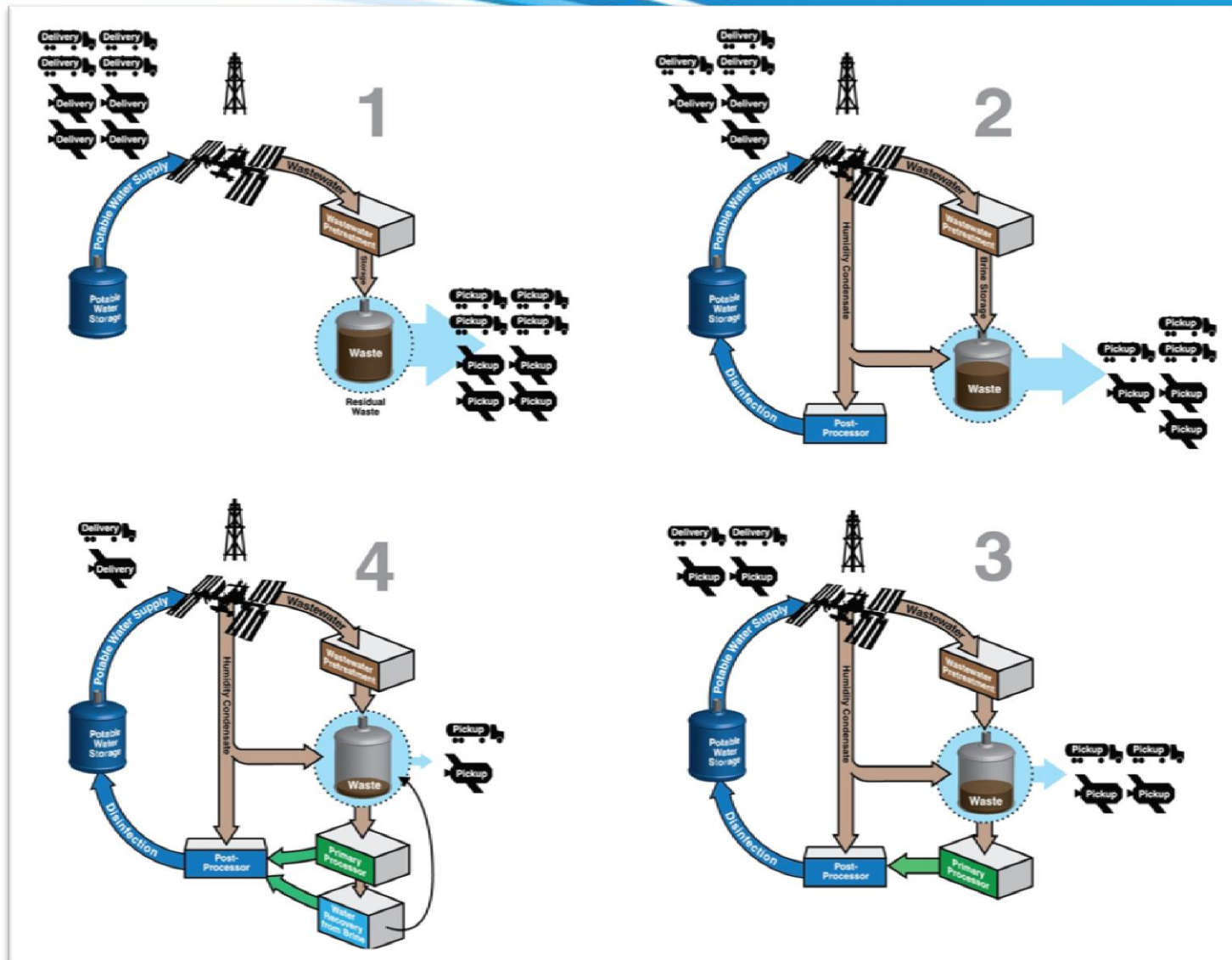


# Integrate systems to solve water supply problems





# Analogies between Earth & space



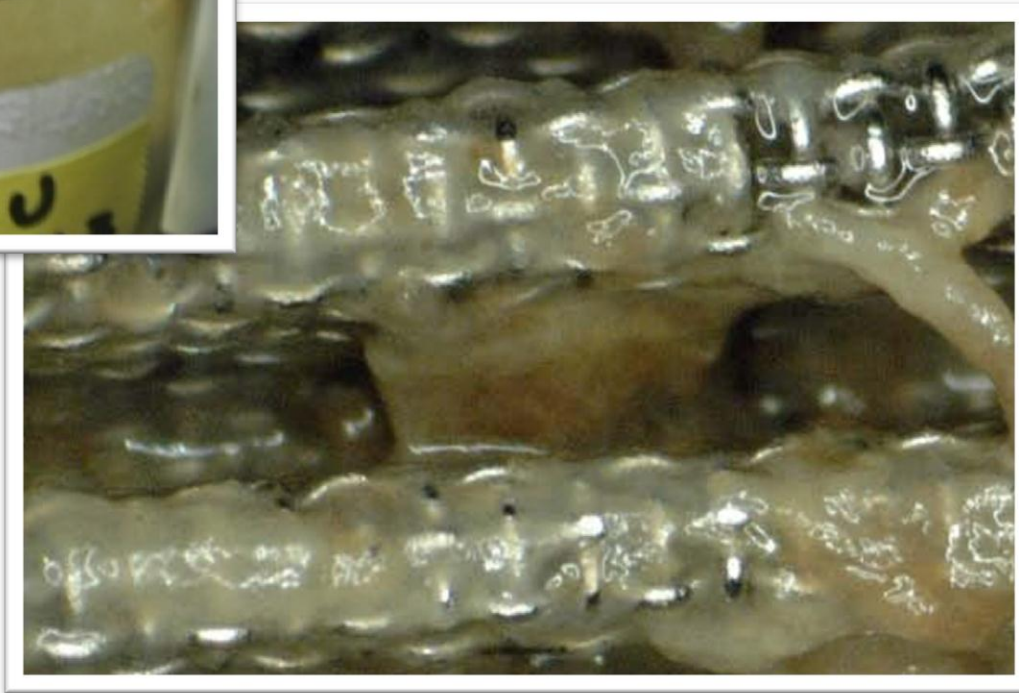
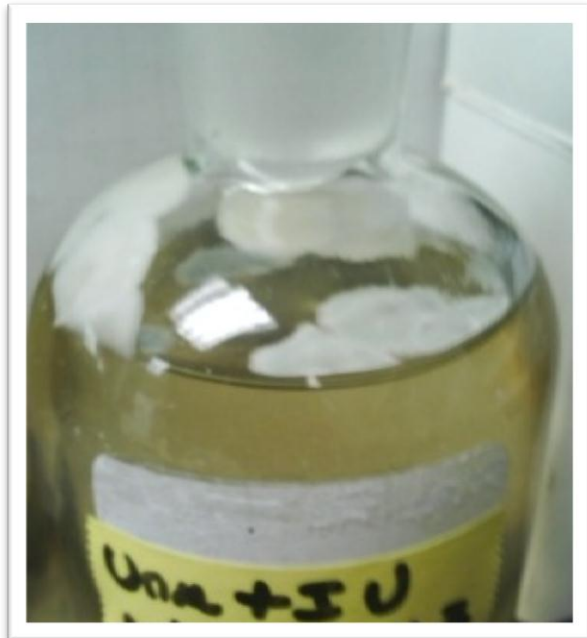


# TECHNOLOGIES

CREW AND THERMAL SYSTEMS DIVISION



# Waste stabilization & disinfection



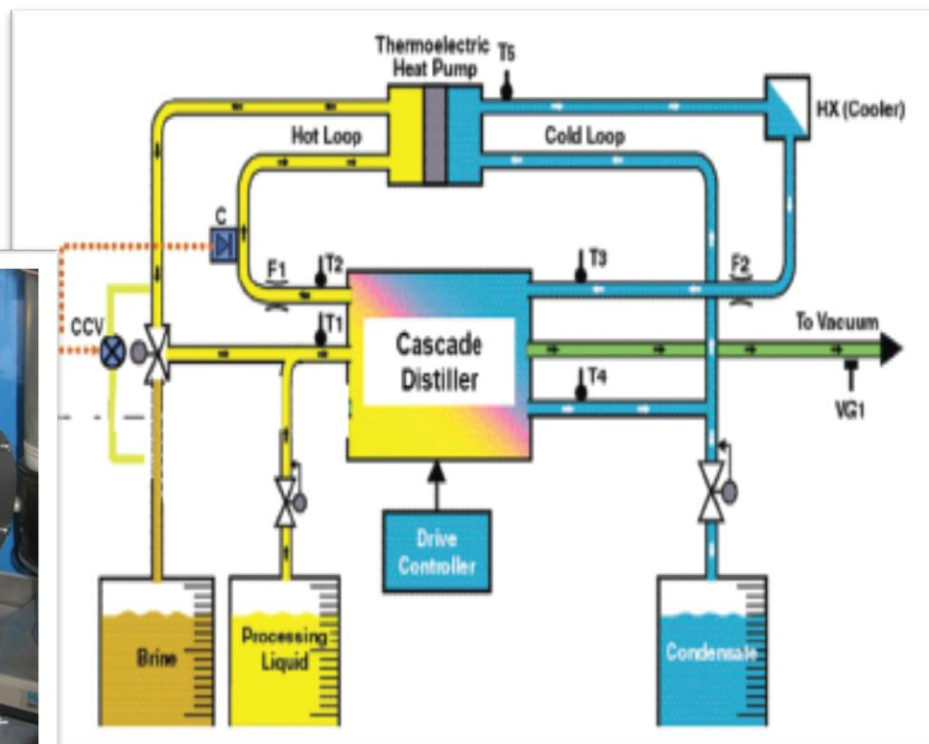
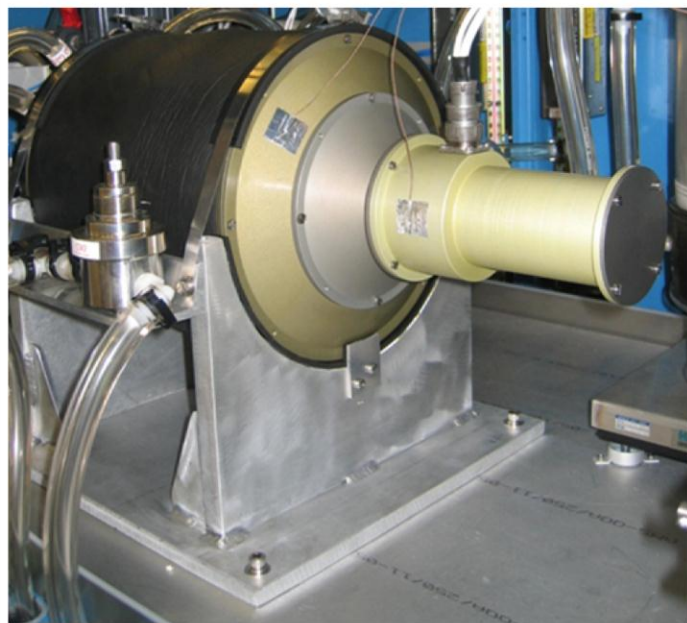




# Biological treatment systems

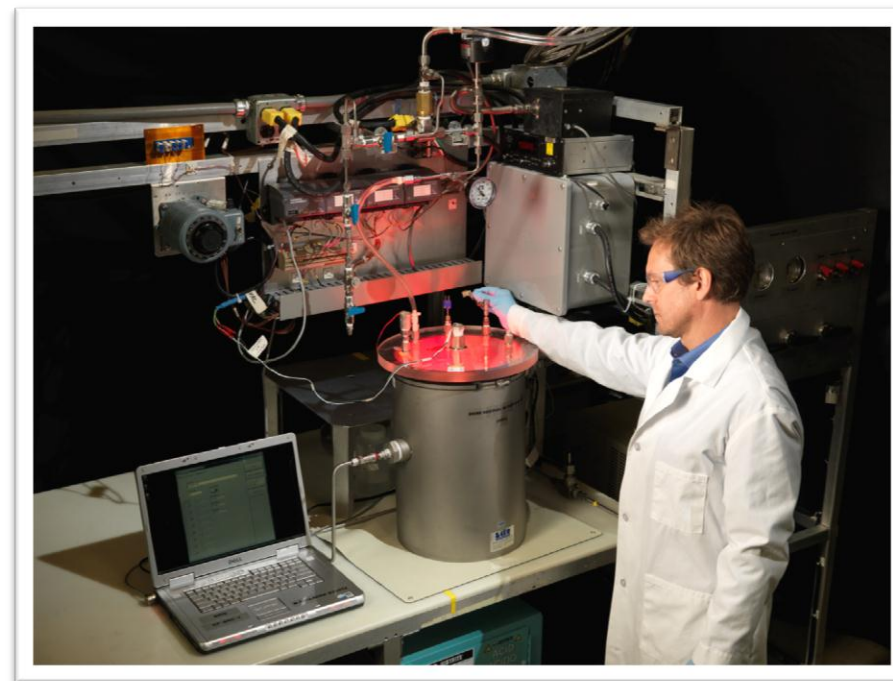
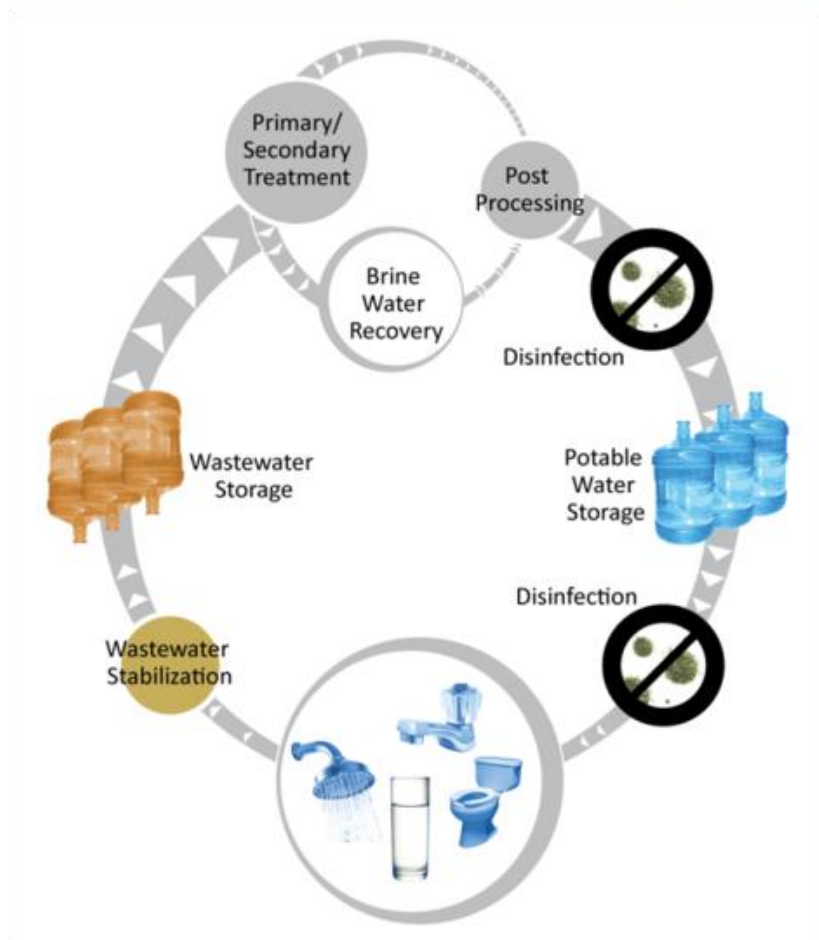


# Distillation systems





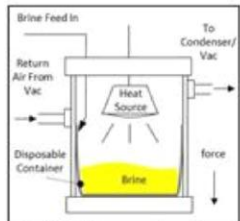
# Water recovery from brines



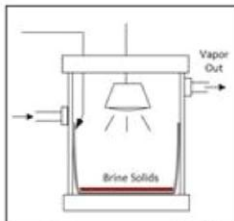




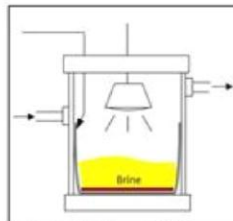
# Brine recovery = zero-liquid discharge



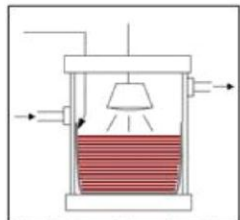
Step 1. Fill evaporator with layer of liquid brine.



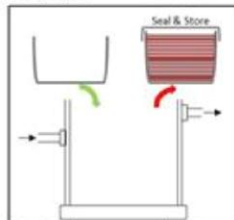
Step 2. Evaporate to solid brine residual. Collect vapor at condenser.



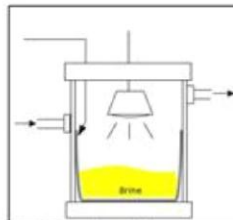
Step 3. Add more liquid brine.



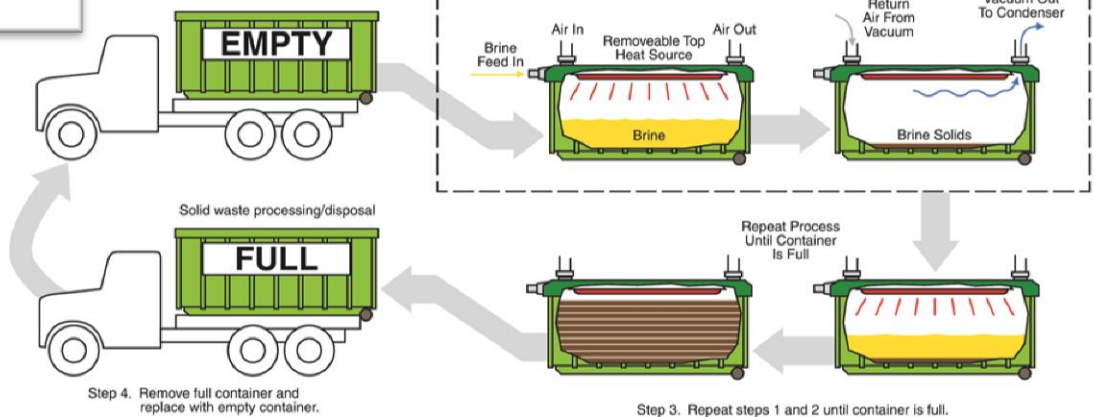
Step 4. Repeat Steps 1-3 to layer brine solids until container is full.



Step 5. Remove used disposable container, replace with new.

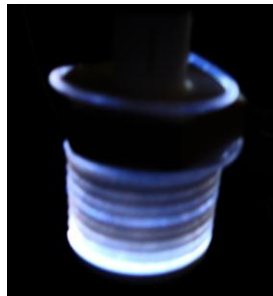


Step 6. Continue brine processing as required with refurbished system.

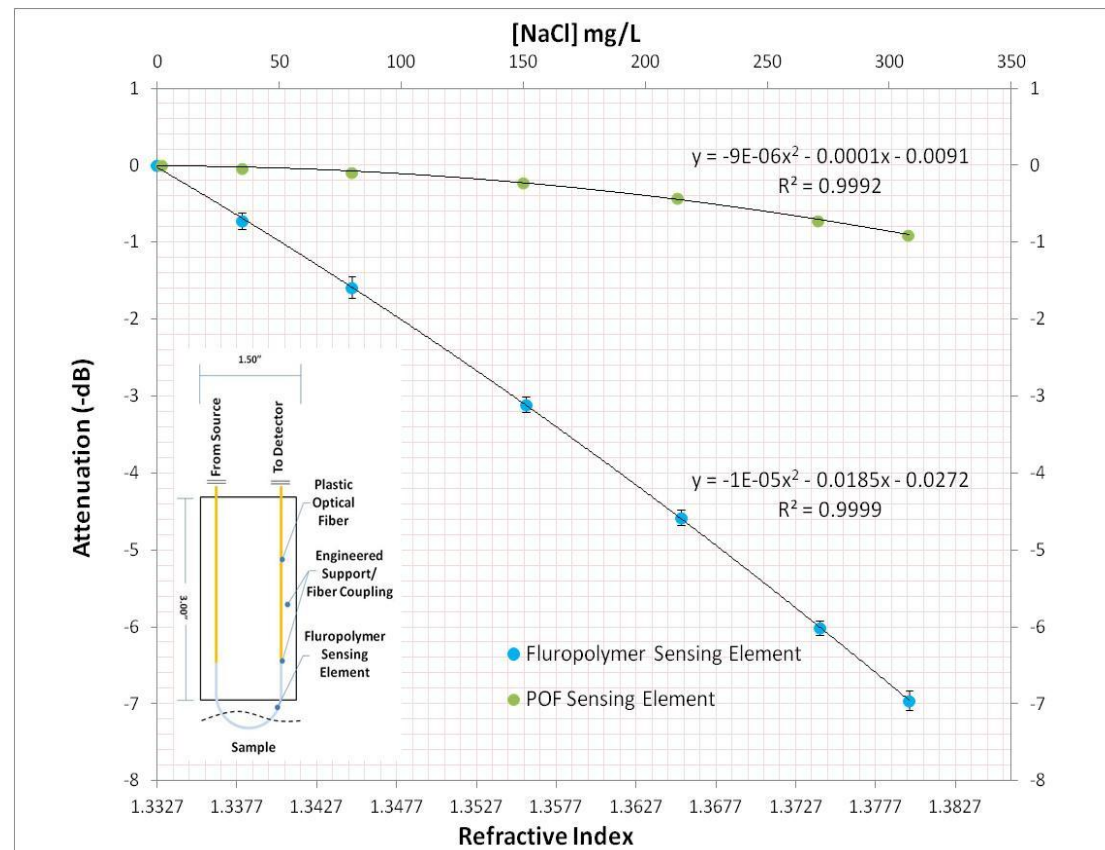




*Fiber Optic Sensor Head (enlarged)*



*Fiber Optic Sensor Head (illuminated)*

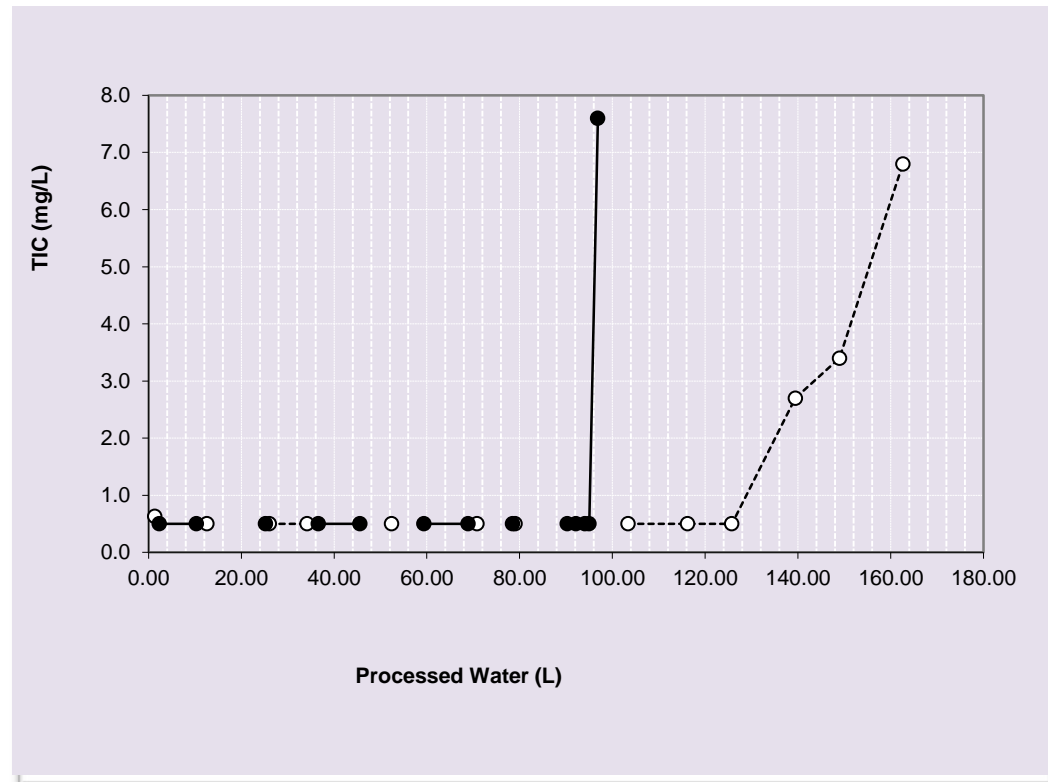


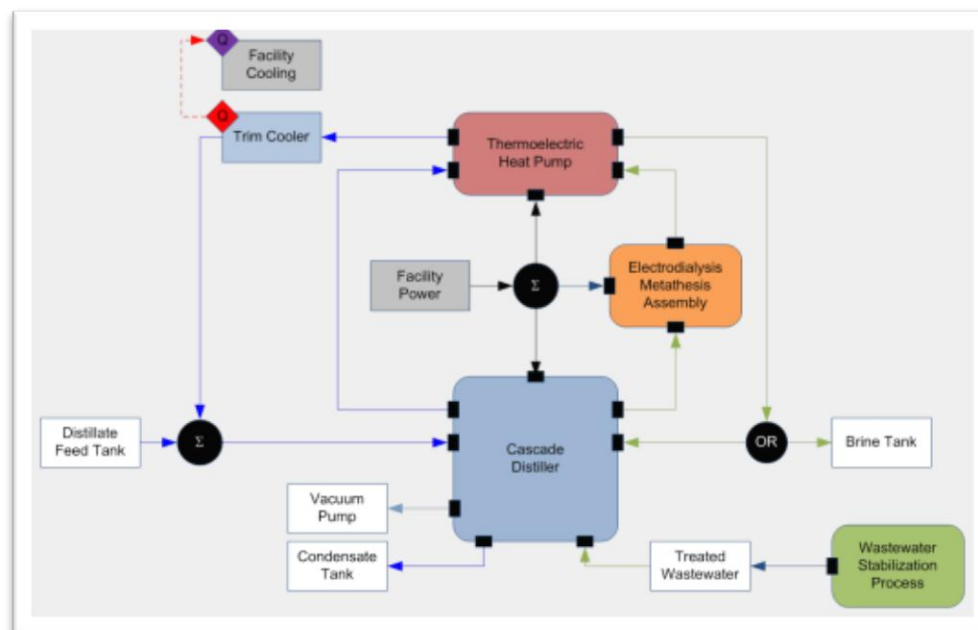
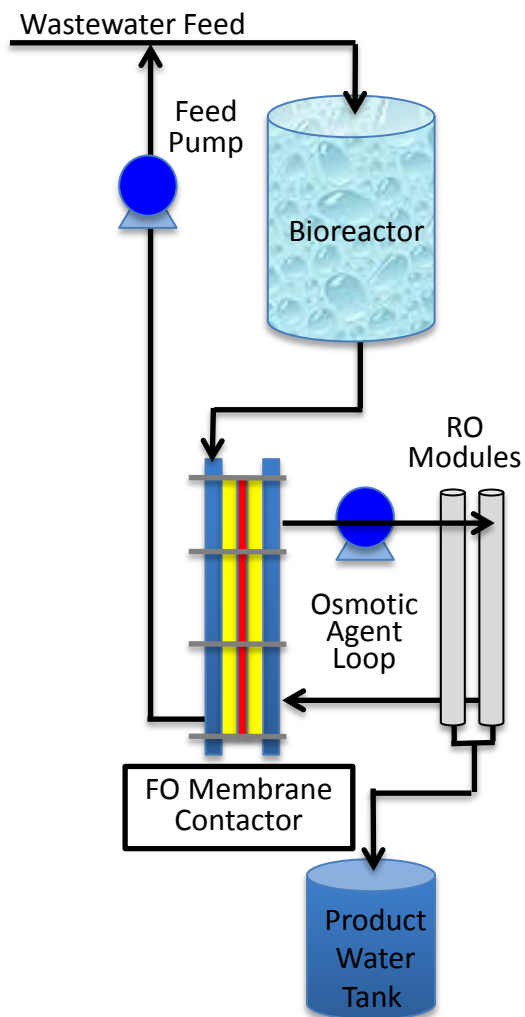


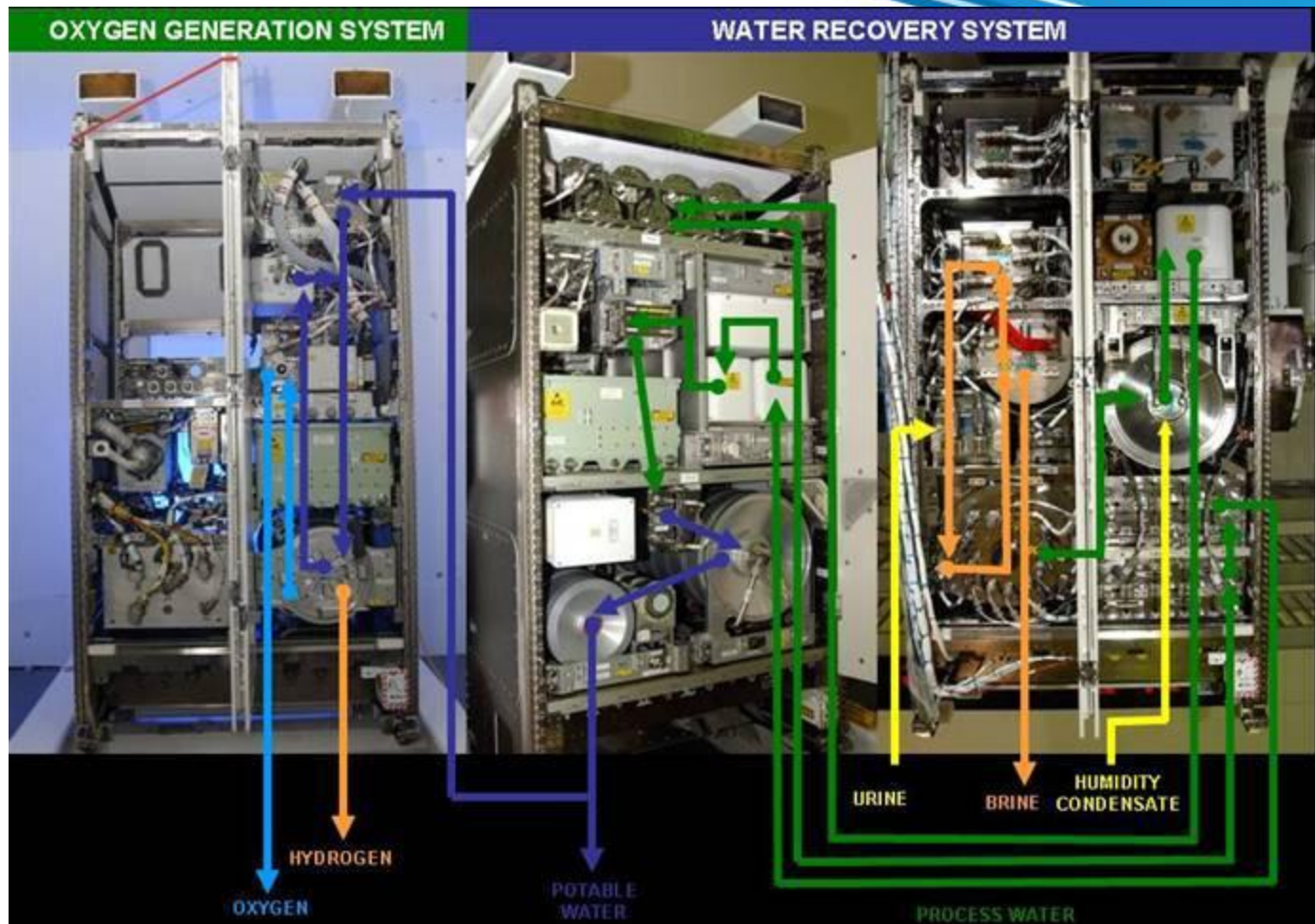
# INTEGRATED TREATMENT SYSTEMS

CREW AND THERMAL SYSTEMS DIVISION













# WRS Technology Team Capabilities



- Advanced Water Recovery Systems Development Facility
  - System development
  - Integrated testing
  - Water quality analysis
  - Microbial analysis





# Contact

**Karen D. Pickering, Ph.D.**

2101 NASA Parkway / EC3

Houston, TX 77058

[karen.d.pickering@nasa.gov](mailto:karen.d.pickering@nasa.gov)

281-483-2688

**Michael R. Callahan, Ph.D.**

2101 NASA Parkway / EC3

Houston, TX 77058

[Michael.r.callahan@nasa.gov](mailto:Michael.r.callahan@nasa.gov)

281-483-3479